Sandia National Laboratories

MFG S&T Quarterly

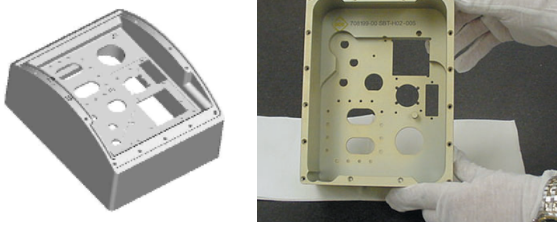
MFG Science & Technology That Makes a Difference

August 2003—Vol. 1 No. 4

Model-Based Product Acceptance Team Awarded NNSA Weapons Award for Excellence

The Model-Based Product Acceptance (MBPA) Team was awarded a 2002 National Nuclear Security Administration (NNSA) Weapons Award for Excellence for producing the first-ever model-based mark-quality weapon products accepted by NNSA. The first products were accepted by the NNSA Weapons Quality Division during December 2002, in the Manufacturing Enterprise of Sandia's Mfg S&T Center, and subsequently sent to the Kansas City Plant's bonded stores for use in B61 Trainer Assemblies.

Model-Based Product Acceptance is defined as "a method of manufacturing, measuring and accepting mark-quality products using only the solid model and qualified processes." The component selected was the MC2894 preflight controller housing for the B61-4 Type 3E Trainer, shown in both model and final product form below.



Model (left) and finished product (right)

This significant milestone has broken the barrier of creating a 3-D electronic design definition that contains all the information necessary to fabricate, measure, submit and accept mark-quality weapon products. This entails a detailed equivalency determination between the model and the drawing to ensure that all information on the drawing is in the model, and any ambiguities have been eliminated. The Center's modeling techniques help resolve ambiguities.

Configuration settings may effect definitions. Further, while a drawing contains a hole location table and signage, the model shows these in an absolute manner, with no signage. Improved measurement reporting occurs, as feature and dimension information on the drawing are replaced with visual references on the model, which are helpful in communicating how the measurement results were derived.

The processes and capabilities developed by the team are required for producing and using quality-controlled 3-D electronic design definitions as an alternative to 2D drawings to perform weapon production and acceptance.

This Advanced Design and Production Technology (ADaPT) sponsored project partnered Sandia, NNSA, and the Kansas City Plant to develop the baseline capability that will be expanded as the complex works together to establish common practices required for future model-based capabilities in support of the Life Extension Program.

Future MBPA development will include the following steps:

- Select a part for next MBPA project
- Exercise the MBPA process through outside supplier(s)
- Participate in development of corporate MBPA training courses
- Develop new measurement techniques using Calypso software for Coordinate Measurement Machines

Lessons learned from the first MBPA product were:

- Avoid products with legacy design issues
- Follow established quality procedures and work instructions
- Confirm that Software Quality Assurance plans are in place
- Designers should follow modeling standards, so that equivalency checks between model and drawing will go smoothly

Sandia team members were Douglas G. Abrams, Ronnie L. Albers, Maureen R. Baca, Edwin A. Bryce, Patricia A. Barthelmes, Jo D. Bridge, Peter Chauvet, Perry J. Cowen, Gary M. Gallegos, Monico A. Lucero, William R. Nance, James H. Paustian, Jane M. Poppenger, Ray A. Sanchez, Terrance T. Smith, Lee Rieger, Daniel G. Pellegrino, Larry Varoz, and Jamie L. Welles.

External team members were Gary Eckert, Louis R. Perez and Rick L. Pierson (DOE/AL), and Jim Reilly, Don Schilling, Don Rathburn, and Lisa Vernon, (KCP).

Stephen S. Baca was the team leader.

Contact: Terry Smith (505-844-7438, ttsmith@sandia.gov)

Advanced Manufacturing Trades Training Program (AMTTP)

In cooperation with the Metal Trades Council, New Mexico technical institutes and Albuquerque Public Schools (APS), Sandia created the Advanced Manufacturing Trades Training Program (AMTTP). The AMTTP is a two-phase program that recruits and trains students in the crucial trades areas of electronic fabrication, machining, and materials science. The phases consist of Mutual Education of Skills Training (MEST) and Specific Trades Training. In addition, the AMTTP program utilizes skill standards that align with the National Coalition for Advanced Manufacturing (NACFAM).

Students in the AMTTP receive on-the-job training, and the following personal and professional benefits: paid internship, insurance for students, flexible schedule, hands-on experience, and mentoring.

Partners

- Sandia National Laboratories (SNL)
- SNL Student Internship Program
- Metal Trades Council
- APS
- New Mexico technical institutes
- San Juan College
- Luna Community College
- National Coalition For Advanced Manufacturing

(AMTTP, continued on page 4)

Tech Updates

Manufacturing Enterprise Continues Effort in High Speed Machining

Delivery requirements of a large and geometrically challenging steel Monolithic Ballasted Penetrator (MBP) mold used to produce prototype penetrators, an integral part of the Tactical Missile Systems–Penetrator (TACMS-P) project, prompted the Manufacturing Enterprise (ME) to consider and use in-house High Speed Machining (HSM) capability for fabricating this mold on time with required surface finishes.

The ME had previous experience in this type of mold fabrication at a smaller scale with less geometric detail and more lead-time. The ME and customer, Al Foster of Aerospace Systems Development Center, used knowledge gained from previous work[1] and decided to integrate HSM into the fabrication of the two mold halves. The previous mold fabrication process included outsourcing of the mold to an external grinding facility to grind internal features. The mold material was 1006 mild steel, which is a difficult material to obtain the required surface finishes using conventional machining methods. This outsourcing typically took three weeks.

The project began in December 2002 with the following key sequences and delivery of completed mold halves the first of March 2003:

1. Initial customer contact with ME to negotiate deliverable and timeline
2. Discussion about lessons learned from previous mold project with Machinist Tradesmen

High speed machining of mold for Monolithic Ballasted Penetrator

3. Recommendation by Machinist Tradesmen to use HSM
4. Customer follow-up meeting
5. Establish manufacturing sequences
6. Mold fabrication
7. Coordinate actual machining, NC programming and Mechanical Measurement operations
8. Concurrent manufacture of mating hardware
9. Mold halves fit check
10. Contact customer upon completion

Critical ME personnel with manufacturing expertise in the following areas were required: CAD, NC Programming, HSM, Mechanical Measurements, machining, grinding and scheduling.

By successfully completing the MBP mold, the ME demonstrated that finishing the mold geometry at Sandia with HSM was the appropriate decision and furthered the establishment at Sandia of this advanced HSM manufacturing capability. The ME's use of HSM enabled the customer to meet the delivery schedule to the Army and the Navy (see SNL Lab News, 3/21/03). In addition, this team's efforts have helped forge a stronger relationship between the Mfg. S & T Center and the Aerospace Systems Development Center. The Manufacturing Enterprise has demonstrated expertise in HSM techniques, which will promote partnerships with other customers.

Contacts: Doug Abrams (505-844-1124, dgabram@sandia.gov)

Daryl Reckaway (505-844-5705, dereckа@sandia.gov)

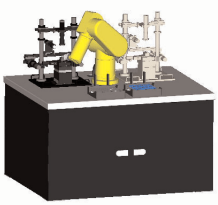
1. Production Staging Project "Improved Manufacturing of MC4531 Mold Bodies Using High Speed Machining (HSM)"; also see article "High Speed Machining (HSM)—Better, Faster AND Cheaper" in MFG S&T Quarterly, November 2002

Automated Visual Inspection System (AVIS) in Ceramics and Glass Departments

The Ceramics and Glass Department currently employs human operators to inspect active ceramic voltage bars. The manual inspection process is a tedious and labor-intensive operation performed with high-power microscopes. With voltage bar production capacity increasing, the inspection effort will consume approximately 1.2 FTE per year. The department has developed an Automated Visual Inspection System (AVIS) to improve inspection quality and throughput and also help reduce the dependence on human operators. The system, shown at right, will reduce voltage bar inspection labor requirements by 70%.

The AVIS system consists of a structured-lighting inspection station, a 6 degree-of-freedom manipulator, specialized sensors and tooling, a mounting table and part trays enclosed in a laminar flow hood. The large table provides a rigid physical structure to accurately position the system hardware and accommodate additional inspection stations as required. The laminar flow hood not only provides a clean inspection environment but also provides a human exclusion area for safe manipulator operations. Safety interlocks will be provided to prevent unauthorized motion or entry into the workcell. A separate control rack houses the host PC, solid state relays, power supplies and motion controllers.

Inspection operations begin when an operator opens the interlocked workcell door and inserts a loaded tray and an empty tray into their respective tray receivers. The loaded tray contains approximately 150 voltage bars. Next, the operator closes the workcell door and activates the system through a graphical user interface on the PC. The manipulator transports individual voltage bars from the part tray to a precision 3-axis positioning station for each inspection. The inspection station uses micro-focusing lasers, high-resolution



Automated Visual Inspection System

(Continued, next page)

Organic Materials group provides WR quality items to neutron generator production

The Organic Materials dept., commonly referred to as the Plastics Lab, has been approved at the highest quality level as a supplier of WR items to the neutron generator dept. The Plastics Lab successfully completed an SPQR1050 Quality Systems Survey in May of 2002. The SPQR1050 specification sets forth the minimum quality program requirements necessary to ensure that the product procured by the buyer meets the requirements of the purchase order. The Plastics Lab, since being qualified, has delivered over 1,000 items to the neutron generator bonded stores. It has fabricated epoxy, silicone, and urethane parts for several weapons systems, including W-76, W-80, and W-87. As a qualified supplier it maintains certification and calibration of all processing equipment, and provides written work instructions and travelers for each purchase order. Manny Trujillo and Miriam Hilborn coordinate all WR manufacturing for the Plastics Lab.

—Howard W. Arris (845-9742, hwarris@sandia.gov)

Upgrade of Video Teleconference Capabilities

A new Video Teleconference (VTC) and presentation display system is now in place in the Advanced Manufacturing Processes Laboratory, room A218, thanks to the joint effort between personnel from the Mfg. S&T Center and Videoconferencing and the Collaborative Technologies organization. The project was initiated in 2002 when it was discovered that the former VTC unit, installed in 1996, lacked capabilities needed to communicate effectively with Sandia National Laboratories, CA. Given the aggressive advances of electronic technology, the need for a more responsive VTC system was apparent. The Videoconferencing and the Collaborative Technologies organization made recommendations to purchase and implement a more flexible VTC system. It was determined that a number of infrastructure changes were also required to install the new system, including repositioning of an electronic writing board, projection screen, and upgrade of an existing digital projector. The hardware, a new VTC unit with information processing capabilities, and two 50" plasma monitors were installed early in the calendar year. New electronics, including programming of the system that operates the VTC and laptop computer, will be completed by the end of August through Professional Business Systems, Inc.

—Carla Chirigos (845-8645, cdchiri@sandia.gov)

Automated Visual Inspection System (continued)

video cameras and microscopic optics to capture images of each voltage bar. All six voltage bar surfaces are scanned to detect and measure volumetric features including pits, chips and voids. Software algorithms derived from voltage bar inspection criteria are applied to the features to accept or reject each part. When the inspection is completed the manipulator places the voltage bar in either the accepted or rejected part tray. After approximately 7 hours of inspection, the operator opens the workcell door and removes both part trays. One tray contains accepted parts and the other tray contains rejected parts. All inspection data will be stored on long-term media to provide detailed process records.

Future Development

AVIS will provide the capability to automatically detect pits, chips and voids, which account for approximately 70% of the total inspection time. A new inspection technology is needed to identify cracks, porosity and electrode defects embedded within the voltage bars. These features are identifiable at low magnification and are less difficult for the human operator to detect. The proposed AVIS system includes a large table to accommodate either a second structured lighting station to increase capacity or a new crack inspection technology to provide 100% automated inspection.

Summary

The AVIS will perform approximately 70% of the total voltage bar inspections by identifying pits, chips and voids. The inspection system will:

- Increase production quality by eliminating operator error and variability.
- Increase inspection throughput and provide additional capacity.
- Free operators from manual inspections to engage in other value-added activities.
- Develop uniform inspection technology for manufacturing and production centers.
- Provide detailed process and inspection records.

This new machine tool will enhance the strategic partnerships with customers, as they seek manufacturing solutions and delivery of hardware.

Contact: Ron Stone (505-844-4853 rgstone@sandia.gov)

Insider News

Lockheed Martin Employee Recognition Awards (ERA) program

Several Mfg. S&T teams and an employee were the recipients of ERAs for 2003. Within the Mfg. S&T, Michelle Griffith was recognized for her individual technical excellence. Also within the Division two teams containing members from the Mfg S&T Center were recognized:

The Current Stack Production Team (Victoria Abeyta, Phyllis Chavez, Tom Chavez, Carlos Cisneros, Rita Coslow, Robert Gallegos, Warren Lubin, Johnny Moya, Roderic Nagel, Johnny Rice, Lisa Romero-Spencer, Margaret Sanchez, and Angel Abeyta, all from the Ceramics and Glass department).

The Division 14000 Financial Team (Anna Baca, Carla Chirigos, Cynthia Cordova, Albert Noriega, and Mary Sanchez).

A number of other individuals were members of teams receiving awards in other Divisions, including the Heavy Bridge Project (Henry Baca, Bart Chavez, Ernie Correa, Sam Griego, and James Hickerson); MC4277 Neutron Tube Ion Source Team (Ron Goeke); MC4277 Brazed-Subassemblies Process Improvements and (Tony Bryce); Sandia Solid-State Lighting (Phil Cole, John Emerson, and Steve Thoma).

Congratulations to all winners.

—Carla Chirigos, (505-845-8645, cdchiri@sandia.gov)

Insider News

What happened to Building 841?

Building 841 was identified as a structure that needed extensive modernization, including seismographic updates, which would have taken more than a year. A study revealed that a major renovation would require a complete evacuation of equipment and personnel. Building 841 was designed and built to house laboratories and shops; it had outlived its original intent. Demolition began on July 8, 2003.

During the planning stage, the importance of the technologies that were housed in Buildings 841 and Building 842, and their link with science and technology capabilities, were immediately recognized. A team from the Division and Sandia's facilities department located a new site for Metal Preparation (also known as Raw Stock) by slightly remodeling Building 867, and Raw Stock moved—which left Building 842 almost completely vacant.

Precision Welding and Mechanical Fabrication moved into Building 842, as did Precision Metal Forming. The lapping activities moved into Building 840 and High Energy Density Welding relocated to Building 867. All of the activities have been relocated; the shops are up and running and business is beginning to normalize. The majority of the displaced technologies lost floor space and the relocation has created some distance hardships, but the staff's desire to excel is surmounting the obstacles.

—Joe Stephenson (505-284-9089, jdsteph@sandia.gov)

Kudos

Yoosuf Picard, a University of Michigan student intern working with David Adams in Thin Film, Vacuum and Brazing, won one of two student awards at the recent American Vacuum Society New Mexico Chapter symposium. His presentation discussed pointwise synchrotron microbeam strain mapping of multilayer MEMs mirrors. He will receive an all-expense paid trip to the AVS 50th International Symposium to be held in Baltimore, MD.

Yoosuf Picard

Mfg. S&T Center TRAT Winners

The Teamwork Recognition Awards Team (TRAT) promotes teamwork and provides positive feedback to groups that have achieved excellence as a direct result of teaming.

The goal is to foster and reward teamwork in the Mfg. S&T Center by the ability to work together toward a common vision and the ability to direct individual accomplishments toward organizational objectives.

The TRAT is responsible for reviewing and determining which teams will receive Gold, Silver or Bronze awards.

The winners for this cycle were:

Jaw Implant Prototype Team—GOLD
CMS Prototype Fabrication Team—SILVER
Monolithic Ballasted Penetrator Mold Team—SILVER
Computer Application for Mfg. ISO Registration Team—BRONZE
Electron Generator High Voltage Development Team—BRONZE
Electronic Fab Project Lead Team—BRONZE
Electronic Fabrication Quality Team—BRONZE
Greenbelt Team—BRONZE
Humble Birch—BRONZE
Internal Fabrication Quality Procedure Team—BRONZE
Mfg. S&T Quarterly Newsletter Team—BRONZE
Model-based Production Team—BRONZE
Ogive Assemble Team—BRONZE
VCT Special Projects Team—BRONZE

Congratulations to all!

—Julie T. Marquez (505-844-7614, jtgibso@sandia.gov)

OA Security Audit

A large team from the DOE Office of Independent Oversight (OA) will conduct a major security audit this August and September. This audit will go beyond the normal periodic DOE reviews both in scope and duration. A similar OA team inspected Los Alamos National Laboratory (LANL) in 2002 and identified several issues related to cyber security. In particular, the OA found problems with LANL's management and control of wireless technology. No doubt they will take a close look at SNL's wireless applications as well.

As the audit approaches and more specific informationis obtained, the Center's computer users will be informed through email. As always, if you have questions concerning any aspect of computer security, please call or email Bill Hughes, your Computer Security Representative, 505-845-0794, wbhughe@sandia.gov

New Employees

Archuleta, Kim	14172
Palmer,Jeremy A.	14184
Craven,William W.	141811
Heister,Jack D.	141812
Miller,Richard D.	141814
Nekoranec,Joseph N.	141814
Cottle, Jeremy	14186
Lucero, Monico	14186
Gallagher,Thomas E.	141862

(AMTTP, continued from page 1)

Machining & Metrology AMTTP

Sixteen studends from three different schools (Albuquerque Technical Vocational Institute, San Juan College in Farmington, NM; and Lake Superior College in Duluth, MN) are currently in the Machining discipline of the AMTTP. Eleven are Advanced Trainees

Three students have graduated from the program, they are: Dennis Kuchar, Charles Myers, and Jeremy Cottle.

The Metrology discipline has eight students currently enrolled in AMTTP, all from Albuquerque T-VI. One is an Advanced Trainee and one student, Monico Lucero, has graduated from the program.

Electronics AMTTP

The Electronic Fabrication discipline has 35 students enrolled in the AMTTP from various schools (Albuquerque TVI; West Mesa, Cibola and Albuquerque high schools, and Luna Community College). Ten of the students are Advanced Trainees and 18 are MEST students. Seven students have graduated from the program, (Irma Romero, Eddie Ayon, Leroy Valdez, Jeannette Kelton, Meliton Gonzales, Dennis Carlson and Tracy Jaramillo).

Materials AMTTP

The Materials discipline of the AMTTP has no MEST students currently in the program, however there are eight Advanced Trainees. Four students have completed the Materials AMTTP program (Rose Torres, Carter Hodges, Cynthia Pepe, and Kim Archuleta.)

For additional information about the Advanced Manufacturing Trades Training Program please visit the following web site. http://mfgshop.sandia.gov/1400_ext/1400_ext_AMTTP.htm

Contact: Tom Souther (505-844-7492, tmsouth@sandia.gov)

14000 Employee Council

The 14000 Employee Council serves as an avenue for communication between management and employees on issues concerning quality of life both at work and in the community. It strives to contribute to improving the environment to create an inclusive workforce. It meets every month to discuss employee concerns and events for the Council to consider sponsoring. The 14000 Employee Council has taken an active role promoting diversity workshops. Stay tuned for notification as to when its web page becomes operational.

Council members represent many levels within our Division. John Sayre chairs this committee. Members from the Manufacturing S&T are Gilbert Benavides, Phyllis Chavez, Carter Hodges, Jane Poppenger, and Jack Stephens. Other members are Jeannie Bekaye, Dale Blankenship, Becky Campbell, Lorraine Cordova, Vieta Crain, Edith Hendrix, Robert Mattison, Michael McClafferty, and Ruth Varga.

Please contact any Employee Council member if you have questions or concerns that the Council could help you address.

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. SAND2003-2785P